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LEGAL NOTICE

UNITED STATES ATOMIC ENERGY COMMISSION
Technical Information Service Extension, Oak Ridge, Tennessee

Field Trial of Treatments Affecting Strontium Uptake

Uptake of Sr89 by soybeans or bluegrass was measured following artificial contamination of the soil surface in a field experiment. Effects of various combinations of tillage treatments and additions of lime on this uptake were determined. The uptake of calcium by the crops was determined and the ratios of Sr89 to calcium calculated for the soil and crops.

The experiment was located on a level area of Elkton silt loam at the Plant Industry Station, Beltsville, Maryland. This soil had average pH values of 5.25 in the 0-12 inch layer and 4.9 in the 12-18 inch layer, with a standard deviation between 25 foot square plots of ±0.15. In the 0-12 inch layer of the same plots there was 2.7±0.4 meq. exchangeable Ca per 100 grams of soil. The soil was plowed and worked down to a seedbed condition several weeks before the surface was contaminated. The entire area was enclosed with a fence and an 18 inch earthen dike to prevent run-off. A shallow ditch was left inside the dike in it's construction.

The tillage and lime treatments were such as might be practical on agricultural land in eastern United States. For the crop of soybeans, the Sr89 was left on the surface, rototilled into a 6 inch layer of soil, plowed under to 6 inch depth, or buried 15 inches below the surface. Lime was applied with the rototilled treatment at rates of 0, 4, or 8 tons per acre. With the other tillage treatments, only the four ton per acre rate of lime application was used. In the buried treatment, the lime was either buried with the Sr89, or raked into the surface soil after burial

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of the Sr89. As a check treatment Sr89 was left on the surface without lime as well as with the four ton per acre application. Only the surface and rototilled treatment with 0 and 4 tons of lime per acre were used for the bluegrass sod. Each treatment was replicated three times.

In order to facilitate the operation of the tillage implements, a split block design was used in the experiment, with all of the rototilled treatments in the same row of each replicate. The plot area for the tillage treatment with soybeans was 9 feet by 15 feet. In the center of this, an area 6 feet by 10 feet received the Sr89 and lime. Three rows of soybeans were planted 36 inches apart on each plot, and analyses were made on the harvest from the center row. With the bluegrass sod, the plot area was 4 feet by 6 feet, the entire area receiving the Sr89, lime, and tillage treatment. The harvest was taken from an area 2 1/2 feet by 4 1/2 feet in the center of the plot.

A uniform application of Sr89 was made by spraying on the surface of the soil, except the deep placements of Sr89 were made in pits 15 inches deep, and the surface application on grass was made on top of the grass. The Sr89 was obtained on May 18, 1954 from Oak Ridge National Laboratory as solution of irradiated $Sr(NO_3)_2$, with a specific activity of 3.97 millicuries per gram Sr. The intended rate of application was 100 microcuries per square foot. The radioactive solution to be applied to each plot was diluted to one liter. This solution was applied with one pass at slow walking speed of a mounted spray boom five feet in length. The radiation level immediately after application was 5-8 mr./hr. at five

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feet over the [illegible]

[illegible]

deep [illegible]

[illegible] filter with water, [illegible] One corner of the [illegible] plots was sometimes covered with standing water. The water [illegible] from the filter [illegible] on June [illegible], and after the [illegible] bottom. A [illegible] of [illegible] water, taken after [illegible] on August [illegible] and [illegible], [illegible] suspended in the water.

[illegible] soybeans were planted on May [illegible] [illegible] grass plots [illegible] September [illegible] [illegible]

The plant materials were analyzed [illegible] [illegible] weighed, and ground. [illegible] sample of plant material was [illegible] This was then filtered and [illegible]

with additional [illegible] to give 200 ml. of solution. This mixture dissolved essentially all of the [illegible] and Ca. The [illegible] was [illegible] with a [illegible] for [illegible] counting. A [illegible] aliquot of the [illegible] was digested with nitric and perchloric acids, and the Ca content determined by titration with [illegible] ethylenediamine tetra-acetate.

The yields and Ca content of the harvests are given in Table I. Yields were quite variable and were not significantly affected by the tillage or lime treatments, so only the averages for each harvest are given.

The yields of Sr-89 and Ca in the crops (Table II) gives a good indication of the relative uptake of Sr-89 with the different treatments. Due to the experimental design, comparisons are more exact within blocks than they are between blocks. With soybeans the highest uptake of Sr89 was obtained when the surface contamination was [illegible] into the [illegible] six inches of soil, although it was not significantly higher than the uptake from some of the treatments in the other tillage. Lime applications were effective, but deep placement of Sr-89 was quite ineffective in reducing uptake of Sr-89 by soybeans. With bluegrass the application of lime was ineffective; the grass took up significantly less Sr89 from the rototilled treatments, at [illegible], than from the surface treatments. [illegible] treatments and [illegible] the differences are not significant. The higher yields of Sr-89 and Ca in bluegrass [illegible] from the fact that it came up [illegible] did the soybeans.

Table 1. Yield and Ca Content of Soybeans and Grass

Harvest	Soybeans		Grass	
	Yield	Percent Ca	Approximate Yield	Percent Ca
1	45 gm.	1.78	60	.96
2	202	1.82	60	.59
3	590	1.60	60	.56

Table 2. [illegible]

[illegible]	[illegible]	[illegible]
Block A		
Surface, 3 lime	[illegible]	[illegible]
Surface, 4 lime	[illegible]	[illegible]
Plowed, 4 lime	[illegible]	
Deep, 4 lime raked in	[illegible]	
Block B		
[illegible], 3 lime	[illegible]	[illegible]
[illegible], 4 lime	[illegible]	[illegible]
[illegible] lime	[illegible]	
Deep, 4 lime mixed	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Table 3. Percent of Applied Sr89 Taken Up By Soybeans with Different Tillage Treatments and Additions of Lime

Placement of Sr89	Rate of Lime Application	Sr89 Taken Up By Soybeans
	Tons/Acre	Percent of Application
Block A		
Surface	0	0.67
Surface	4	0.59
Plowed 6 in. deep	4	0.76
Buried 15 in. deep	4 (raked in surface)	0.99
Block B		
Rototilled 6 in. deep	0	1.54
Rototilled " "	4	0.62
Rototilled " "	8	0.70
Buried 15 in. deep	4 (buried 15 in. deep)	0.52
L.S.D. (.05)		0.46
L.S.D. (.05) in different blocks		0.91